



South Portland, Maine 04106

Title: **Advanced Automotive Diagnostics**

Catalog Number: **AUTO-270**

Credit Hours: **4**

Lecture (or Lab): **2 hours lecture / 4 hours lab**

Instructor: **Joseph Moore**

Total Contact Hours: **30 / 60**

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Course Syllabus

Course Description

The second of two courses, this course is a comprehensive overview of automotive electronic fuel injection systems and vehicle emission systems. Students will learn to utilize proper diagnostic procedures and determine appropriate corrective procedures to repair, replace, or install components that cause poor engine performance. Students will be introduced to emission controls, their purpose on OBDII engines and their effect on engine performance when they are not operating properly. Prerequisite: AUTO-210.

ASE Student Certification Test

The final week of this course will consist of an ASE Student Certification Test. It will be administered at the Testing Center, located in the Campus Center building. Students will be responsible for taking the test at their convenience during the normal operating hours of the Testing Center. A photo ID is required. For information about the Testing Center, please see www.smccme.edu/tests

Course Objectives

Upon successful completion of this course, the student will be able to:

- Identify the systems and components of the fuel and emission systems and explain their significance
- Identify and perform necessary diagnostic procedures given current information
- Utilize Scan Tools to retrieve and analyze information determine appropriate diagnostic procedure

- Determine necessary action to replace, repair, or reinstall components

NATEF Task for this course (some materials will be covered in Auto 260 and will be required knowledge as part of this course):

VIII. ENGINE PERFORMANCE

For every task in Engine Performance the following safety requirement must be strictly enforced:

Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

A. General Engine Diagnosis

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| 1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. | P-1 |
| 2. Identify and interpret engine performance concern; determine necessary action. | P-1 |
| 3. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins. | P-1 |
| 4. Locate and interpret vehicle and major component identification numbers. | P-1 |
| 5. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. | P-2 |
| 6. Diagnose abnormal engine noise or vibration concerns; determine necessary action. | P-3 |
| 7. Diagnose abnormal exhaust color, odor, and sound; determine necessary action. | P-2 |
| 8. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. | P-1 |
| 9. Perform cylinder power balance test; determine necessary action. | P-2 |
| 10. Perform cylinder cranking and running compression tests; determine necessary action. | P-1 |
| 11. Perform cylinder leakage test; determine necessary action. | P-1 |
| 12. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action. | P-1 |
| 13. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action. | P-3 |
| 14. Verify engine operating temperature; determine necessary action. | P-1 |
| 15. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action. | P-1 |
| 16. Verify correct camshaft timing. | P-1 |

B. Computerized Engine Controls Diagnosis and Repair

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| 1. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable. | P-1 |
| 2. Diagnose the causes of emissions or driveability concerns with stored or active diagnostic trouble codes; obtain, graph, and interpret scan tool data. | P-1 |
| 3. Diagnose emissions or driveability concerns without stored diagnostic trouble codes; determine necessary action. | P-1 |
| 4. Check for module communication (including CAN/BUS systems) errors using a scan tool. | P-2 |

5. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action. P-1
 6. Access and use service information to perform step-by-step diagnosis. P-1
 7. Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, or similar systems); determine necessary action. P-3
 8. Perform active tests of actuators using a scan tool; determine necessary action. P-1
 9. Describe the importance of running all OBDII monitors for repair verification. P-1
- C. Ignition System Diagnosis and Repair**
1. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action. P-1
 2. Inspect and test ignition primary and secondary circuit wiring and solid state components; test ignition coil(s); perform necessary action. P-1
 3. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action. P-1
 4. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary. P-2
- D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair**
1. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems; determine necessary action. P-1
 2. Check fuel for contaminants and quality; determine necessary action. P-2
 3. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action. P-1
 4. Replace fuel filters. P-2
 5. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air. P-2
 6. Inspect and test fuel injectors. P-1
 7. Verify idle control operation. P-1
 8. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action. P-1
 9. Perform exhaust system back-pressure test; determine necessary action. P-1
 10. Test the operation of turbocharger/supercharger systems; determine necessary action P-3
- E. Emissions Control Systems Diagnosis and Repair**
1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action. P-2
 2. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action. P-2
 3. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action. P-1

4. Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action. P-1
5. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action. P-2
6. Diagnose emissions and driveability concerns caused by the secondary air injection and catalytic converter systems; determine necessary action. P-2
7. Inspect and test mechanical components of secondary air injection systems; perform necessary action. P-3
8. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action. P-3
9. Inspect and test catalytic converter efficiency. P-1
10. Diagnose emissions and driveability concerns caused by the evaporative emissions control system; determine necessary action. P-1
11. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action. P-1
12. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action. P-1

F. Engine Related Service

1. Adjust valves on engines with mechanical or hydraulic lifters. P-1
2. Remove and replace timing belt; verify correct camshaft timing. P-1
3. Remove and replace thermostat and gasket/seal. P-1
4. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action. P-1
5. Perform common fastener and thread repairs, to include: remove broken bolt, restore internal and external threads, and repair internal threads with a threaded insert. P-1
6. Perform engine oil and filter change. P-1
7. Identify hybrid vehicle internal combustion engine service precautions. P-3

Topical Outline of Instruction

- Review of Fundamentals
- Fuel Injection Principles, Components and Operation
- Fuel Systems
- Emission and Evaporative Systems and Controls
- OBD II Strategies
- Five Gas Analysis

Course Requirements

- Students will successfully complete homework, quizzes and tests.

- Students will successfully complete shop projects as assigned and approved by instructor and maintain documentation of completion.

Student Evaluation and Grading

- 10%: Attendance and Participation
- 10%: Homework
- 20%: Quizzes
- 30%: Tests
- 30%: Practice of Safety and Shop Participation

Electude modules will be assigned periodically through the course. Each module will be counted as a quiz grade and if not completed by the due date will result in a zero for that quiz. Electude involves some time commitment do not wait to the last minute.

Attendance Policy

Students will be dropped a letter grade from their final grade for 10% of total hours. Students will be dropped an additional letter grade at 13%. (For example: Received A for class but 10% absences now translates to a B for the final grade. 13% absence would translate to a C.) Students missing 15 % of the total hours for the course, tardy or absent will result in an administrative failure (AF) for the class. For this course meeting 3 hours per day twice a week, means 15% is 13.5 hours. Tardies will count as .5 hours no matter time missed unless greater than .5 hours which then will be counted as time missed. Tardies are considered not seated at the time of the start of class. Tardies will add up. Students will be removed with an AF if 3 consecutive absences.

Example A final grade

10%	9 hours	B final grade
13%	11.7 hours	C final grade
15%	13.5 hours	AF

Text, Tools and/or Supplies

- Automotive Technology: Principles, Diagnosis, and Service, 4th Edition, by James Halderman (ISBN 9780132811057)
- Electude by Argo subscription. Voucher to be purchased at the school bookstore
- Each student must supply and maintain his or her own set of tools as listed on the “SMCC Automotive Technology Required Student Tool List.”

- Personal protective equipment must be worn at all times in lab. Leather, steel-toe work boots; clear safety glasses with side shields; and a uniform are required for this course.

Office Hours

Appointments can be made to accommodate student needs. Please call or email for an appointment.

End-of-Course Evaluation

Students complete evaluations for each course attended at SMCC. Evaluations are submitted online and can be accessed through the student portal. Students can access the course evaluations beginning one week before the end of classes. The deadline for submission of evaluations occurs Monday at 5 PM following the last day of the class. You will receive an email to your student email account when course evaluations are available.

ADA Syllabus Statement

Southern Maine Community College is an equal opportunity/affirmative action institution and employer. For more information, please call 207-741-5798. If you have a disabling condition and wish to request accommodations in order to have reasonable access to the programs and services offered by SMCC, you must register with the Disability Services Coordinator, Sandra Lynham, who can be reached at 741-5923. Further information about services for students with disabilities and the accommodation process is available upon request at this number. Course policies about online testing are modified to suit each individual's accommodations.

SMCC Pay-for-Print Policy

Per Page Costs

Each semester students receive a \$20 printing credit. The balance resets at the end of the semester and any remaining credits are removed. The cost varies depending upon page size and whether printing is done in black and white or color.

- a. There is a \$0.10 per page fee for standard 8.5" by 11" black and white documents. The reverse sides of duplex (double-sided) documents are free.
- b. There is a \$.50 per page fee for standard 8.5" by 11" color documents.
- c. There is a \$.20 per page fee for 8.5" by 14" (legal) or 11" by 17" (tabloid) black and white documents.
- d. There is a \$1.00 per page fee for 8.5" by 14" (legal) or 11" by 17" (tabloid) color documents.
- e. Duplex charges (printing on both sides of a page) work in the following fashion: One page is \$0.10, two pages are \$0.10, three pages are \$0.20, and four pages are \$0.20, etc. The flipsides are free, but another sheet of paper

is \$0.10. Please be aware that a document with any color at all (when printed to a color printer) will by default be printed in color. You are responsible for setting the print job to print black and white if you do not need color. For directions, please go to the IT Help tab in My SMCC.

How does it work?

The College's pay-for-print system monitors printing on all printers (including those in general access labs, library printers, the Academic Achievement Center, Noisy Lounge and technology labs). Students can check the number of pages they have printed by using the Printing Balance tool available on SMCC computers (located in the lower right corner of the screen, near the clock). Departments with work study students who need to print documents for the department should contact the Help Desk at 741-5696 to have a special account set up.

Refunds

Print jobs are eligible for a refund in the event of mechanical or electronic error on the part of the printer, print server, or software used to submit the job. Jobs are not eligible for a refund in cases where the job was not set up correctly, was submitted multiple times, or the student is not satisfied with the result. To request a refund, please bring the offending print to the IT Department in the basement of the Ross Technology Center. Refunds will be granted in the form of a credit to the student's account.

Why is SMCC charging for printing?

The pay-for-print system is an effort to control escalating printing costs. Charging for printing helps offset the increasing cost of supplies and encourages students to conserve resources. To find ways to reduce your printing charges, please go to the IT Help tab on My SMCC. If you have questions about the pay-for-printing policy or your printing charges, please contact the Help Desk at 741-5696 or send an email to helpdesk@smccme.edu. Be sure to log OUT of the system when you've finished your printing, to prevent unauthorized access to your account.

Add-Drop Policy

Students who drop a course during the one-week "add/drop" period in the fall and spring semesters and the first three days of summer sessions receive a 100% refund of the tuition and associated fees for that course. Please note any course that meets for less than the traditional semester length, i.e., 15 weeks, has a pro-rated add/drop period. There is no refund for non-attendance.

Withdrawal Policy

A student may withdraw from a course only during the semester in which s/he is registered for that course. The withdrawal period is the second through twelfth week of the fall and spring semesters and the second through ninth week of twelve-week summer courses. This period is pro-rated for shorter-length courses. To withdraw from a course, a student must complete and submit the appropriate course withdrawal form, available at the Enrollment Service Center (no phone calls, please). The designation “W” will appear on the transcript after a student has officially withdrawn. A course withdrawal is an uncompleted course and may adversely affect financial aid eligibility. Failure to attend or ceasing to attend class does not constitute withdrawal from the course. There is no refund associated with a withdrawal.

Plagiarism Statement

Adherence to ethical academic standards is obligatory. Cheating is a serious offense, whether it consists of taking credit for work done by another person or doing work for which another person will receive credit. Taking and using the ideas or writings of another person without clearly and fully crediting the source is plagiarism and violates the academic code as well as the Student Code of Conduct. If it is suspected that a student in any course in which s/he is enrolled has knowingly committed such a violation, the faculty member should refer the matter to the College’s Disciplinary Officer and appropriate action will be taken under the Student Code of Conduct. Sanctions may include suspension from the course and a failing grade in the course. Students have the right to appeal these actions to the Disciplinary Committee under the terms outlined in the Student Code of Conduct.